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Intellectual Property: a powerful tool to develop biotech research

Diego Giugni* and Valter Giugni

PROPRIA S.r.I. – Patents Models Trademarks – Via Della Colonna 35, 33170 Pordenone, Italy.

Summary

Today biotechnology is perhaps the most important technology field because of the strong health and food implications. However, due to the nature of said technology, there is the need of a huge amount of investments to sustain the experimentation costs. Consequently, investors aim to safeguard as much as possible their investments. Intellectual Property, and in particular patents, has been demonstrated to actually constitute a powerful tool to help them. Moreover, patents represent an extremely important means to disclose biotechnology inventions. Patentable biotechnology inventions involve products as nucleotide and amino acid sequences, microorganisms, processes or methods for modifying said products, uses for the manufacture of medicaments, etc. There are several ways to protect inventions, but all follow the three main patentability requirements: novelty, inventive step and industrial application.

Introduction

It is well known for those who work in the field of biotechnology that a huge amount of money is necessary to carry out just a single research line. In addition, due to the complexity and uncertainty of experiments, often the adopted research line does not bring to a tangible result useful to recover at least the money invested. However, these difficulties shall not slow down the development of new technologies which have been demonstrated to be the future in several paramount human activities, such as health, agricultural and foods.

In particular, biotechnology potential has not yet been fully exploited, but it has been very well demonstrated what is actually possible to develop by means of biotechnology; just to cite a few emblematic inventions coming out from biotech research think about the PCR (poly-

Received 12 February, 2010; accepted 20 February, 2010. *For correspondence. E-mail dgiugni@propria.it; Tel. (+39) 43420331; Fax (+39) 43421294.

merase chain reaction), monoclonal antibodies, DNA recombinant and stem cells.

Therefore, the interest in biotechnology is and shall always be alive.

The major difficulties encountered by biotech firms are, thus, how to collect money, how to find investors and/or how to obtain funding when the risk of not reaching a final valuable product is so high. Moreover, the complexity and slowness of the pathway to obtain such funding are often a hurdle especially for small/medium firms which, by the way, is the case for most biotech entities in Europe.

The same big pharma/biotech firms are always looking for new ways of financing their researches since there is a strong competition from the growing countries who are able to develop new products at low costs.

In view of said picture, how is it possible to be competitive?

In several cases, Intellectual Property (IP) has been demonstrated to be an actual and helpful tool to develop biotech entities. However, still in relatively few countries such an instrument is largely known and well used.

What is IP and what is a patent

Introduction

In general, an inventor faces the problem of deciding whether to disclose his or her invention or to keep it secret. It is evident that when an invention is presented to other persons who are not obliged to the secret, it is considered disclosed and, thus, it becomes part of the state of the art and everybody can freely exploit the invention.

Conversely, an invention can be kept secret for instance not disclosing how a product was produced. In other words, the know-how to reach the invention remains part of the personal knowledge of the inventor.

The disclosure of an invention has the main aim to render the invention freely accessible to the community, and so improving the technology and, consequently, everybody's life.

Keeping the invention secret gives to the inventor an advantage over the competitor and creates a sort of absolute monopoly, i.e. the inventor is the sole owner of the invention because he or she only possesses the knowhow of the invention and is therefore entitled to economically exploit it.

Intellectual Property can be considered a law system which tries to balance the two above situations, i.e. free access and absolute monopoly.

The IP system

The IP system is a very complex law system which has been developed in the course of centuries.

Very generally, the system comprises a variety of tools which are useful to protect different aspects of inventions, and creates a sort of monopoly. The principal instruments are patents, utility models, designs, trademarks, copyrights, unfair competition and antitrust.

According to literature, the first monopoly appeared about 500 BC; in fact Athenaeus wrote, in the 'Banquet of the Learned', quoting Phylarchus, the historian, that if any confectioner of cook in Sybaris, a Greek colony famous for luxurious living and self-indulgence, invented a peculiar and excellent dish, no other artist was allowed to prepare it for 1 year (Reinhold Publishing Corporation, 1964).

The patent system

The world's first patent procedure was developed in the early Republic of Venice. The first actual patent of invention or importation was granted in 1443 to Antonius Marini, who offered to built 24-flour mills for each borough of the city of Venice. He did not allege that his devices were new but did request that no one else be permitted to built any mills which operated without water for 20 years (Reinhold Publishing Corporation, 1964).

However, Galileo Galilei on 15 September 1594 received a patent for a device for raising water and irrigating land. He claimed to be able to discharge water through 20 spouts with the motive power of a single horse and successfully operated his machine in a garden. His right extended for 20 years and the decree provided that infringers would lose their machines and be required to pay a fine of 300 ducats (Reinhold Publishing Corporation, 1964).

The first patent law is dated 1624 when the Statute of Monopolies passed before the English Parliament. Indeed, this act was really a declaration of the common law in this area. The patent term was limited to 14 years (Reinhold Publishing Corporation, 1964).

Many other property rights forms were developed during the subsequent periods in different countries all over the world. The most important treaties for Europe are the Paris Convention (PC) stipulated in 1883, the European Patent Convention (EPC) stipulated in 1973 and the Patent Cooperation Treaty (PCT) stipulated in 1970. In any case, all the states have adopted a national patent law which can differ one from the other on particular matters.

The PC has been adopted by several countries all over the world. Such countries to which this Convention applies constitute a Union for the Protection of Industrial Property. Further, the protection of industrial property has as its object patents, utility models, industrial designs, trademarks, service marks, trade names, indications of source or appellations of origin, and the repression of unfair competition. Moreover, industrial property shall be understood in the broadest sense and shall apply not only to industry and commerce proper, but likewise to agricultural and extractive industries and to all manufactured or natural products, for example, wines, grain, tobacco leaf, fruit, cattle, minerals, mineral waters, beer, flowers and flour (Art. 1 PC).

According to Art. 2 PC, nationals of any country of the Union shall, as regards the Protection of Industrial Property, enjoy in all the other countries of the Union the advantages that their respective laws now grant, or may hereafter grant, to nationals; all without prejudice to the rights specially provided for by this Convention. Consequently, they shall have the same protection as the latter, and the same legal remedy against any infringement of their rights, provided that the conditions and formalities imposed upon nationals are complied with. Articles 4A(1) and 4C(1) state that any person who has duly filed an application for a patent, or for a registration of a utility model, or of an industrial design, or of a trademark, in one of the countries of the Union, or his or her successor in title, shall enjoy, for the purpose of filing in other countries, a right of priority during a period of 12 months for patents and utility models, and 6 months for industrial designs and trademarks. This means that for instance an applicant for a patent can file a first application in a country and then has 12 months to extend said application in other countries claiming the priority date of said first filing. In other words, for the purpose of considering prior art, the filing date is to be the first filing date.

It is to be noticed that the PC does not grant patents but establishes general unified principles governing the patent system.

The EPC has been developed to create a centralization system to grant patents which are recognized by all the contracting states. Over 20 states met at a diplomatic conference in Munich in 1973 to discuss the introduction of a European patent grant procedure. In addition to all 27 European Union (EU) member states, Croatia, Iceland, Liechtenstein, the Former Yugoslav Republic of Macedonia, Monaco, Norway, San Marino, Switzerland and Turkey belong to the European Patent Organization. Recently, the EPC has been revised and the EPC 2000 entered into force on 13 December 2007 [European Patent Office (EPO), update September 2009]. The EPC system allows the grant of a patent with a single procedure which has been accepted and recognized by all the contracting states.

The PCT system was developed with the task to try to simplify and unify the different patent procedures of



Fig. 1. EPO contracting states. Extension states – states recognizing European patents upon request: AL: Albania; BA: Bosnia and Herzegovina; RS: Serbia (legal successor of the former State Union of Serbia and Montenegro into the Cooperation and Extension Agreement) (European Patent Office, 2010).

the different countries all around the world. In particular, it has been created an internationally recognized filing system performing an International Search Report, a Written Opinion on the patentability of the claimed invention and, optionally, an International nonbinding Preliminary Examination. As for the EPC, the PCT is a centralized procedure. However, differently from the EPC, it does not grant patents but it is necessary to enter the national phases to prosecute with the grant of the corresponding rights. In particular, the PCT permits to postpone the entering into the national phases up to 30-31 months from the date of filing, or of the priority if claimed. Therefore, it allows to postpone up to 2.5 years the decision to invest a considerable amount of money when the situation is still uncertain.

As can be understood, the patent system generally aims to territorially protect an invention. In other words, it is up to the inventor to establish where he or she desires to protect his or her invention. Consequently, the 'sort' of monopoly is territorially limited.

Moreover, almost all the patent systems grant patents for inventions for 20 years from the filing date. Accordingly, the monopoly is also temporally limited. After said period of time, the invention becomes freely exploitable.

Grant procedure for an European patent (first filing)

An European patent application can be filed directly with the EPO or, where national states so require, before national competent authorities.

After usually about 6–7 months from the date of filing, the EPO issues a Search Report including a list of documents considered more or less relevant to assess patentability of the claimed invention. With the Search Report, a Written Opinion on patentability is also issued on the basis of the documents cited in the Search Report.

After 12 months from the filing date, it is possible to extend the European application to cover extra-countries outside European contracting states (Fig. 1).

This time limit is also called priority period and allows applicants to extend patent applications maintaining as effective date the filing date of the European application, according to the above PC articles.

After 18 months from the filing date, the application is published. In other words, a patent application is secret for a period of 18 months from its filing date. The application should be published with the Search Report, while the Written Opinion is available on request or on the EPOLINE website.

After 24 months from the filing date, if the Search Report is published with the application, it is necessary to

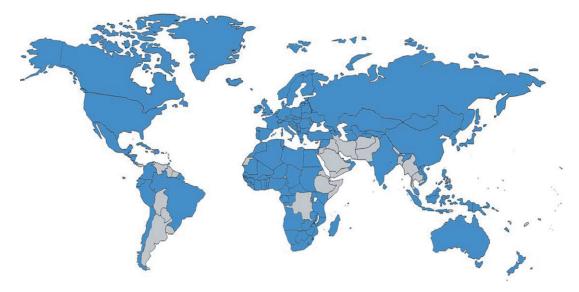


Fig. 2. PCT contracting states (141 on 1 July 2009) (World Intellectual Property Organisation, 2009).

request the examination of the application and to designate the states paying the necessary fees. If the Search Report is not published with the application documents, then the request and the designation are to be done within 6 months from its publication.

After the request for examination is filed, the examination procedure starts. Its timing cannot be foreseen because there are no time limits. However, the average time to conclude the grant procedure from the filing of the application is 3-4 years.

After the grant of the patent, there are 3 months to validate the patent application in at least one of the designated states, otherwise the patent will be considered withdrawn. In any case, the patent is considered withdrawn in those states in which no validation is performed.

PCT procedure (first filing)

A PCT international patent application can be filed directly before the International Bureau of Geneva, the EPO or national competent authorities, depending on national requirements.

After usually about 6-7 months from the date of filing, an International Search Report including a list of documents considered more or less relevant to assess patentability of the claimed invention is issued. With the Search Report, an International Written Opinion on Patentability is also issued on the basis of the documents cited in the Search Report.

After 12 months from the filing date, it is possible to extend the PCT application to cover extra-countries outside PCT contracting states (Fig. 2).

This time limit is also called priority period and allows applicants to extend patent applications maintaining as effective date the filing date of the PCT application, according to the above PC articles.

As above, after 18 months from the filing date, the application is published. The application should be published with the Search Report, while the Written Opinion is rendered available.

Apart for particular states, generally within 22 months from the filing it is possible to file a request for an International Preliminary Examination. Within 28 months from the filing, said examination procedure ends with the issue of an International Preliminary Examination Report.

Similar to the European procedure, after 30/31 months from filing, the national or regional phases must be entered with specific filings, otherwise the application is considered withdrawn. From now, single phases start according to national or regional procedure (World Intellectual Property, 2007).

National procedures

Without entering into details of each national procedure, generally grant procedures divide into simple administrative procedure without any kind of substantial examination which brings to the grant of the patent but only a check of the formal requirements, and procedure comprising a substantial examination.

What is a patent, actually

From a juridical point of view, as can be understood from the above, a patent is a juridical institute allowing the inventor to use exclusively an invention for a certain period of time (20 years from the filing date). It is a kind of contract between the inventor and the state, wherein the state allows the inventor to exploit the invention in a sort of monopoly and for a period of time and the inventor describes the invention in order to render it publicly available and exploitable after the expiry of said period of time, or before it but under his or her explicit consent.

It is to be noticed that only inventions are patentable not discoveries. An invention is generally defined as a new and inventive solution of a technical problem. It is therefore fundamental that an invention is to be based on a technical matter, i.e. it shall have a technical character. In other words, it is needed a technical human intervention to modify what is already present in nature.

On the contrary, a discovery is generally recognized as the simple knowledge of what was already present in the nature, but it does not solve a problem and does not have a technical character. In other words, there is not human intervention to technically modify the reality.

Just as simple example to understand the above difference think about the discovery of acetyl salicylic acid in the bark of willow trees.

The invention is acetyl salicylic acid as a drug to be used in the treatment of inflammations.

Practically, a patent is a technical-legal document comprising a description beginning with a title to identify the object of the invention, a brief statement of the field of the invention, a brief description of the state of the art and in particular of the technical problem the invention aims to solve and the explanation of the object of the invention preferably with specific embodiments. It further comprises at the end of the description the claims which define the limits of the legal protection of the patent. Drawings, tables or graphics can also be present to facilitate the understanding of the description.

Patentable inventions

General requirements

It is worldwide accepted that an invention to be patentable shall satisfy three main requirements:

- novelty;
- · inventive step; and
- industrial application.

The novelty requirement is to be intended as absolute novelty, i.e. the invention shall be considered to be new if it does not form part of the state of the art. The state of the art, or prior art, shall be held to comprise everything made available to the public by means of a written (articles, textbooks, etc.) or oral (conferences, seminars, etc.) description by use, or in any other way, before the date of filing of the patent application. It is to be noticed that even the disclosure of the invention before its filing by the same inventor is considered novelty destroying. Moreover, the definition of 'made available to the public' also includes the potential availability to the public. In addition, generally no language requirements and/or place of disclosure of the prior art is necessary therefore for instance even a publication in Japan in Japanese can be considered novelty destroying of an European patent application. It is also to be noticed that novelty is evaluated taking into account of single items of the prior art, i.e. the invention shall be novel in view of a single prior art, no combination of different prior arts is permitted.

There are some exceptions to the above novelty requirements which would require though a separate analysis. In any case, it could be useful to know that according to the US patent law there exists a grace period for the inventions disclosed up to 1 year before the filing date. However, a careful case-by-case analysis is to be performed when such a kind of disclosure happens.

The inventive step requirement is often a matter of much more discussion than the novelty requirement. In fact, while novelty can be recognized if no prior art discloses exactly the same subject matter of the claimed invention, i.e. all the same features, to access the inventive step is much more questionable. Generally, an invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art. The concepts to be taken into consideration are what is 'obvious' and who is the 'skilled person in the art'. 'Obvious' refers to an invention which is immediately evident, trivial or can be reached in a straightforward manner combining the teachings of the prior art. The skilled man in the art is to be intended as a technical expert in the field of the invention who has the common general knowledge, but who does not perform inventive activities, in other words he or she is not expected to solve technical problems (T500/91, Technical Board of Appeal Decision of EPO) (European Patent Office, 2006). In particular, he or she has access to all items of prior art and has the normal means and capacity of routine work and experimentation (Guidelines for Examination of EPO, C-IV,11.3) (European Patent Office, 2007a). It is to be noticed that, contrary to the novelty requirements, the inventive step is generally denied when two prior arts are cited, one of which identifies the closest prior art, the latter lacking of one or more features which are present in another prior art and have the same inventive effects, i.e. solve the same technical problem.

The industrial application is a practically implicit requirement. In any case, it generally refers to the possibility to always reproduce the invention in an identical manner and to bring an advantage to the state of the art.

Biotechnological inventions

In the field of the biotechnology, the above requirements apply. However, due to the peculiarity and complexity of the subject matter, several and crucial special issues are to be taken into account.

In the course of years, due to the great capacities of biotechnology and the ethical implications deriving therefrom, it has been worldwide discussed over a lot on inventions concerning biotechnology because of the so different approaches from different countries.

In Europe, the EU Directive No. 98/44/EC 1998 has been issued to try to harmonize the protection of biotechnological inventions within the EU. Moreover, it has been recognized that biotechnology and genetic engineering are playing an increasingly important role in a broad range of industries and the protection of biotechnological inventions will certainly be of fundamental importance for the Community's industrial development. Also, in the field of biotechnology and genetic engineering, research and development require a considerable amount of high-risk investment and therefore only adequate legal protection can make them profitable (Consideranda 1 and 2). It has been stated that it is important to assert the principle that the human body at any stage in its formation or development, including germ cells, and the simple discovery of one of its elements or one of its products, including the sequence or partial sequence of a human gene, cannot be patented (Considerandum 16). However, a biological material which is isolated from its natural environment or produced by means of a technical process may be the subject of an invention even if previously occurred in nature [Art. 3(2)]; the same principle applies to an element isolated from the human body or technically produced, including sequence or partial sequences of genes or proteins, may constitute a patentable invention [Art 5(2)]. It is important to notice that the industrial application of a sequence or a partial sequence must be disclosed because the simple description of a sequence is considered a mere discovery and cannot be patented; therefore technical problems and/or uses must be specified.

Patentable biotechnological inventions also include plants or animals if the technical feasibility of the invention is not confined to a particular animal variety and a microbiological or other technical process or a product obtained by means of such a process. Conversely, plant or animal varieties or essentially biological processes for the production of plants or animals are excluded from patentability [Art. 53(b) EPC].

The above considerations come out because significant progress in the treatment of diseases has already been made thanks to the existence of medicinal products derived from elements isolated from the human body and/or otherwise produced, such as medicinal products resulting from technical processes aimed at obtaining elements similar in structure to those existing naturally in the human body and, consequently, research aimed at obtaining and isolating such elements valuable to medicinal

production should be encouraged by means of the patent system (Considerandum 17).

Further, the EPC explicitly rules out the possibility of patenting methods for the treatment of the human or animal body by surgery or therapy and diagnostic methods practised on the human or animal body; this provision shall not apply to products, in particular substances or composition, for use in any of these methods [Art. 53(c) EPC] (European Patent Office, 2007b). The exclusion of such methods is based on ethical and public health considerations, i.e. medical or veterinary treatments should be free from restrain.

However, it is to be noticed that the issue of the therapeutic and non-therapeutic treatment and the use of surgery are under discussion before the Enlarged Board of Appeal of the European Patent Office (G1/07).

A further important exclusion from patentability consists in processes for cloning human beings, processes for modifying the germ line genetic identity of human beings and uses of human embryos for industrial or commercial purposes, said exclusions being clearly contrary to order public or morality.

Only as a note, in the USA the methods of treatment are considered patentable.

In general, a further important requirement for patentability is the sufficiency of disclosure. This requirement is much more important for biotechnological inventions. Basically, the sufficiency requirement states that a patent application shall disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. This requirement becomes obvious in the light of the above general principle that the patent system shall render public an invention. However, in particular cases as in biotechnology it could be difficult to actually disclose an invention just due to its nature. Think about, as it will be exemplified later, microorganisms which undergo to mutations.

Types of biotechnological inventions

Basically, biotechnological inventions are related to products, processes or methods and uses.

Common patentable biotechnological invention products are nucleic acids sequences, amino acidic sequences, plasmids, vectors, antibodies, antigens, epitopes, microorganisms as viruses, phages and bacteria, plant and animal cells, hybridoma and plants and animals not being varieties, and the like.

Examples of what and how can be claimed as above products in a biotechnological patent are exemplified in the following. In particular, sequences can be protected by simply reporting its three-letter code or one-letter code. Plasmids and vectors can be identified in terms of their components, restriction map or again their sequence.

Microorganisms can be described referring to their deposit number to a qualified collection centre.

- · A gene coding a protein involved in carotenoid biosynthesis, which has nucleotide sequences selected from a group consisting of nucleotide sequences represented by SEQ ID NO (nucleotide sequences omissis).
- · A naked non-viral recombinant vector containing DNA encoding a peptide comprising an amino acid sequence set forth in SEQ ID No.: 1.
- A bacterial preparation comprising one or more isolated and purified strain(s) selected from MAR3A or MAR3B which produces one or more bioactive compositions.
- An isolated cartilaginous marine animal-derived immunoglobulin-like molecule which binds to human hepatitis Be antigen (HBeAg) and/or human hepatitis core antigen (HBcAg) or a precursor or processed form thereof or a fragment thereof.

With particular reference to the microorganisms, it is to be noticed that useful bacteria, fungi, algae or other organisms which have been genetically modified for several purposes as for instance to provide microorganism able to produce in great amount a substance having therapeutic effect have to be very well described so that the skilled man in the art can reproduce them, according to the above sufficiency of disclosure. It is well known for biologists that due to the mutations easily occurring in microorganisms, it is not possible to guarantee the stability of their properties. Therefore, usually it is requested that the microorganism be filed in a collection centre. Said centres are present all around the world and are specialized in the conservation of selected species or varieties.

Processes or methods may include methods for producing a particular substance, process of cloning new microorganisms, methods to create new probes or amplifying vectors. Examples are the following:

- · A method to establish transgenic seaweeds, comprising the following steps: constructing the vector for transformation by inserting the high-plant or algae-derived promoters upstream of foreign reporter genes or such cassettes that functional genes are fused with antibiotics or herbicide-resistant genes; introducing said recombinated plasmid DNA to seaweed spore with Biolostics as transformation methods; generating the genetic seaweed through natural development process.
- A method for modulating the expression of an endogenous marine invertebrate gene or an endogenous gene comprised in a pathogen that infects said marine invertebrate comprising administering to a marine invertebrate at least one dsRNA that comprises a sequence having substantial sequence homology to said endogenous marine invertebrate gene or said endogenous

pathogen gene under conditions and in an amount sufficient to modulate the expression of said endogenous marine invertebrate gene or endogenous parasite gene.

Use Inventions generally refer to a particular or new use of a known substance or product. Typically, when a new substance or molecule has been isolated or synthesized and it has been found that it has a use for instance in therapy, then said substance or molecule can be protected per se and its use for the production of a medicament. Moreover, an invention can be considered patentable if it has been found that said substance having a known property reveals a new property. As an example, acetyl salicylic acid was known to have anti-inflammatory properties. Subsequently, it has been found that it could have anticoagulant properties. Thus, a patent can be granted for a use of acetyl salicylic acid to produce an anticoagulant medicine. In this example, usually it refers to a 'second (or subsequent) medical use' claim.

Further interesting and valuable inventions in the field of biotechnology are represented by diagnostic and screening methods and kits to be used in said methods. It is well established the importance of a timely and correct diagnosis in particular in the healthy field. Therefore, the need of such instruments represents a social and economic issue. An example of said methods is the following:

An assay to detect an intracellular form of HBeAg, said assay comprising contacting an immunoglobulin-like molecule or an isolated Variable domain of Ig New Antigen Receptor (VNAR) with cells putatively infected with Hepatitis-B Virus (HBV) or a lysate thereof and screening for the formation of a complex between the immunoglobulin-like molecule or the VNAR and the HBeAg.

Similarly, the kits used to detect a particular substance in order to ascertain a condition are widely known. Just to make an example in the field of interest, to detect the presence of a pollutant or of marine species in an expanse of sea a reliable and simple kit is without any doubt of great importance. The following is a typical example:

Kit for detecting biologically active substances on a support, comprising microorganisms in a form stabilized for transport and storage, one or more cultivation media or recipes for cultivation media or the individual components of cultivation media for the microorganisms, characterized in that it contains additives for stimulating the growth and/or luminescence of microorganisms or the biochemical precursors thereof and/or additives for extending the period of luminescence of microorganisms.

Why patenting

As stated above in the introduction of the present article, the patent system was developed to promote the progress of the sciences and useful arts to the benefit of all. Its aim is to encourage innovation and commercial development so that new and useful products are available to society at large. The system provides a balance between public and private interests by allowing inventors limited exclusionary rights in exchange for full disclosure of their inventions. In this manner not only the incentive for private sector investment into research and development of innovative products is provided, but also the dissemination of knowledge and information which otherwise would be kept secret is promoted. Broad access to this knowledge fuels further research, innovation and development. This underlying philosophy and public policy has stood the test of time, successfully producing the intended social benefits.

From the point of view of the companies, as well as private and public research institutes, it is of paramount importance to protect their own investments. It is quite obvious that in a worldwide commercial vision the competitiveness is strong and often it happens that after having spent a lot of money to develop a new technology (and it is particularly true in the field of biotechnology), a company needs to recover said money selling goods or services produced with said technology. However, without a protection, competitors can copy the technology and impose themselves on the market for instance with lower selling prices. It is evident that the recovering on the invested money becomes very hard and the risks are actually high.

Moreover, the aim of patenting is also to gain more money to invest in further developments of technologies, as new apparatuses, devices, reagents, etc. Needless to say that this is obvious for those who plan the investments of a company.

Accordingly, patents, and more generally intellectual property, allows to acquire 'exclusive rights' on any exploitation (production, commercialization, use, import) of the invented technology. This puts the inventor in a privilege position on the market. In other words, he or she is in the best position to sign contracts with partners.

As stated above, patent law strongly inhibits competitors from copying patented inventions and, further, it is a powerful tool to stop in good time infringements.

The possibility to exploit a patented technology at the best means also licensing some productions to other entities avoiding the above risks of copying. Nowadays it is strategic to allow entities of low-cost countries to use under supervision the exported technology. Just think about emerging countries such as India and China where several of the most important worldwide companies have subsidiaries.

A quite important part of the economic power of a company is determined by its intellectual property portfolio. If a company, but similar considerations can be done also for other entities, needs to negotiate a collaboration, a merge or simply the request for funding, one of the first elements that are analysed is the intellectual property. In fact, if there is a good protection on a technology that

means that it is at the best economically exploitable because there is a low risk of competition.

Needless to say that for investors the presence of patents is a guarantee for their money to be invested.

It is now evident that the patents, but more in general the IP, represents a great income source. Economic exploitation of patents can be realized through licensing or selling of the patented technologies. This is widely useful when a company or an institute does not produce or commercialize biotech products but just make a large experimentation. Said entities can indeed file patent applications and license or sell the subject matter covered by said applications to companies producing and commercializing products deriving from said subject matter. The earned money recovered by said activities can be reinvested in new apparatuses, new reagents and new people just to implement the 'production power' and, thus, increasing the science progress.

Patents are collected in several collections all over the world which constitute patent databases of very important and rich information source: just to cite ESP@CENET and EPOLINE as two very useful online free-of-charge patent databases of the EPO, United States Patent and Trademark Office (USPTO) database, and DERWENT and INPADOC as fee-paying online databases. All these databases allow reliable searches by means of key words, international classification codes, applicants or inventors name, filing date and other topics. At the same time, said system allows to monitor activities and researches of other companies in order to be always updated on new technologies and on competitor activities.

Last but not least, patents give 'image prestige' because it is evident that patents are a sign of a significant research activity collecting and attracting qualified people.

In conclusion, why patenting?

Well, some very important people in the past answered to said question in an interesting manner:

An invasion of armies can be resisted, but not an idea whose time has come. (Victor Hugo)

The mind that opens to a new idea never returns to the previous dimension. (Albert Einstein)

What counts is not so much the idea but the ability to believe in it. (Ezra Loomis Pound)

The patent system added the fuel of interest to the fire of genius. (Abraham Lincoln)

Investments in IP: costs and how to seek funding

Costs

Investments in IP are usually medium-long investments. In fact, normally investments are made at an early stage of the development of a product, i.e. when basic experimental data are available. This means that it could take a lot of time before reaching the commercial product and, in the mean-

time, it is necessary to prosecute the application till its grant, which involves relative large amount of money.

For instance, it has been calculated that an European patent having a description of about 20 pages, covering six states and maintained up to 10 years can have an average cost of 35000 EURO, excluding in-house preparation costs for the patentee and considering an average of the costs all around the Europe. It is to be noticed that said cost includes official fees to be paid to the different national or international offices and patent attorney charges.

Obviously, all said costs are to be divided in different times during the whole grant procedure of a patent and related to validation in the different contracting states. It can be said that about half of the costs are to be supported from the filing up to the grant of the patent, the grant procedure lasting on average 3-4 years, the remaining half of costs being the validation in the contracting states after the grant procedure.

With reference to the PCT procedure, as stated above, it concerns a centralized procedure not actually granting patents. However, it can be interesting to evaluate the cost of a sample of a Euro-PCT patent, i.e. a European patent granted starting from a PCT first filing which has been nationalized in Europe and then followed the European procedure.

The average cost for a patent having a description of 25 pages, validated in eight states and maintained for 10 years, excluded in-house preparation costs for the patentee is about 50000 EURO. As above, about 40% of the cost is due during the international phase and during the grant procedure before the EPO and the remaining 60% is due for the validation in the contracting states including national renewal fees and related costs.

How to seek funding

This is a crucial issue for anyone who needs money to start with new projects which require big investments. Biotechnology is perhaps, for the reasons stated above, the most promising and the most risky field. Therefore, seeking funding is not an easy issue.

Basically, funding is private or public funding. Obtaining one rather than the other one is not foreseeable because it depends on several different and unpredictable conditions. However, while the most small and medium entities try often to seek investments in private, for instance through bank institutes, it seems that the trend and the best possibilities come out from public resources, for instance government funding, regional funding and the

In particular, public funding can result difficult to access at because of the bureaucratic procedures. Sometimes the governments themselves do not help with suitable instruments.

On the other side, information available for public funding sometimes are not looked at. National or regional institutes try to give notice of calls for tenders via INTER-NET. There are websites of said institutes that give full assistance to file a demand for funding.

Another way consists in contacting one of those entities specialized in seeking the most suitable funding. Those entities are present in each country and can be found for instance via INTERNET. Just to make an example, Science Parks are often connected to these entities or provide an inside service helping associated researchers to find funding.

It could be more difficult to seek funding from private investors because of the venture capital kind of investments. This requires a fully and well-detailed programme to try to convince private investors. However, the bureaucracy procedure is surely easy and therefore obtaining money could really be quicker.

Independently of the selected source, in principle, patent protection represents without any doubt a strong tool for the investors to decide whether to invest in venture capitals.

Ways for exploiting and enforcing a patent

A valid patent is a strong weapon to be used against competitors, both to attack them directly and to challenge them by developing your business.

A patent has to be considered 'valid' if it has been regularly granted by a national or international authority after an official search and examination procedure and, eventually, an opposition action and an appeal action.

Article 28 of TRIPS [The WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), negotiated in the 1986-1994 Uruguay Round, introduced intellectual property rules into the multilateral trading system for the first time] points out the exclusive rights conferred by a patent.

Where the subject matter of a patent is a product, the patent owner has the right to prevent third parties not having its consent from the acts of: making, using, offering for sale, selling, or importing for these purposes that product.

Where the subject matter of a patent is a process, the patent owner has the right to prevent third parties not having its consent from the act of using the process, and the acts of: using, offering for sale, selling, or importing for these purposes at least the product obtained directly by that process.

The utmost importance of a patent is proved when it is enforced before a court against a counterfeiter. Court procedures are difficult, expensive and take long time, so that a legal action is advisable only in case of a heavy

situation wherein serious economical damages are involved.

In many cases, enforcing a patent starts by sending a warning letter and a following negotiation may lead to an agreement.

Of course, an action before the court becomes necessary when the parties do not find a satisfactory solution of the question. Preliminary measures are normally undertaken, i.e. a description or a seizure.

A description is an order of the court authorizing the patent owner – assisted by a bailiff and a patent expert – to inspect and describe the alleged infringing product or process. The description is an official document which gives the necessary evidence to be used in the following proceedings.

A seizure is an order of the court authorizing the patent owner to block the products considered as infringing the patent and also the means necessary for the production thereof.

* * * *

Article 28 of TRIPS also states that a patent owner has the right to assign, or transfer by succession, the patent and to conclude licensing contracts on exclusive or nonexclusive basis.

Indeed, as stated above, a patent is considered as an intangible asset having an economical value. The evaluation of a patent depends on several parameters, like the age of the patent (to remember that a patent expires 20 years starting from the filing date of the application), the degree of development of the subject matter, the commercial success already reached or potentially achieving, and so on.

There are different methods to valuate intangible assets, some of them are mentioned hereunder.

The 'cost method' is based on the assessment of the amount of money that should be necessary for replacing or reproducing the asset.

The 'market method' evaluates the asset by comparing it with similar assets which are available on the market and whose value is well known.

The 'income method' takes into account the economic result that the asset may produce advantageously for the user.

However, all these methods are somewhat complicated to be applied, so that more empiric approaches are currently used, not to mention that the negotiation between assignor and assignee is always a matter of subjective evaluation and decision.

Overview of patenting in Europe

The OECD (Organization for Economic Cooperation and Development) defined biotechnology as follows:

The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

It is apparent that such a broad definition comprises many fields of human activities.

Biotechnology patents are identified using the International Patent Classification (IPC) system, managed by the World Intellectual Property Organization (WIPO).

A meaningful reference to evaluate the importance and the distribution of the biological patents all over the world is represented by the statistics referred to the patent application filed under the PCT, which has been ratified by more than 140 countries up today.

After a steady growth in the 1990s, the number of biotechnology patent applications filed under the PCT decreased from more than 11 500 applications in 2000 to 8700 in 2006 (–4.6% per year). Conversely, the total number of PCT patent applications increased by an average of 5.7% per year from 2000 to 2006.

Biotechnology patents increased in the 1990s also due to the development of investigation on the human genome. The recent decrease may be explained considering the more stringent criteria for granting patents on genetic material, particularly according the EPC in comparison with the US procedure.

The following histogram (Fig. 3) shows the share of countries in biotechnology patents in the year 2005. Patent counts are based on the priority date and the inventor's country of residence.

Biotechnology is considered to be one of the key technologies that will help enable the long-term sustainable development of the EU, particularly in terms of economic growth, environmental protection and public health.

The data reported in the histogram give a clear information about the position of Europe in the worldwide context. The situation may be considered as satisfactory, because the EU's share remained stable, even if USA is still far and emerging countries are making progress more and more fast.

Table 1 compares the numbers of Biotechnology PCT patent applications with respect to the total PCT patent applications in the years 1994–1996 and in the years 2004–2006. Data are very impressive to evaluate the development of the innovation in biotechnology. BRIICS refers to Brazil, Russian Federation, India, Indonesia, China and South Africa.

At last, looking at biotechnology patent applications filed before the EPO over the period 2002–2004, the EU accounted for 35% of all biotechnology applications, whereas 41% could be attributed to the USA (Fig. 4).

As to the relative importance of the different fields of use (see Fig. 5), the distribution of biotechnology patent

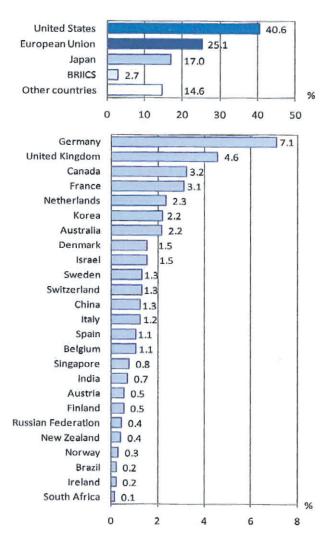


Fig. 3. Share of countries in biotechnology patents 2005. Sources: OECD, Patent and REGPAT Databases, June 2008 and EPO Worldwide Statistical Patent Database, October 2007.

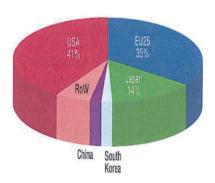


Fig. 4. Share of biotechnology patent applications in the period 2002–2004 per country/region. Source: ETEPS. Institute for Prospective Technological Studies (IPTS) calculations. RoW, rest of the world.

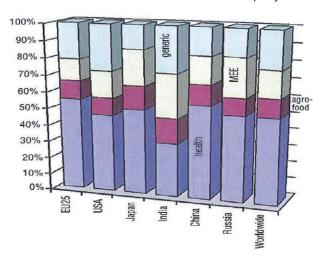


Fig. 5. Distribution of biotechnology patent applications in the period 2002–2004 by sector. Source: ETEPS.

applications shows that health is the most important sector (50%). The second largest sector is generic biotechnology (22%), followed by manufacturing, energy and environment (about 13%) and agro-food (about 10%).

The next diagrams (Fig. 6) compare in percentage the patent applications per origin of technologies filed in 2008 with respect to EPC, the USA, Japan, the most important countries in patenting, and the rest of the world. It can be clearly seen that the USA and Europe are the most active (European Patent Office, 2008).

More in particular, Table 2 shows the numbers of patent applications filed in 2008 per origin and technologies with respect to the different European countries and the most active countries in the rest of the world. The leading countries for biotechnology are the USA and Germany (European Patent Office, 2008).

Conclusions

The survey on the biotechnology patenting given in the present article is clearly not exhaustive due to the complexity of the issue. However, an attempt to provide the persons involved in the biotech field with the basic information on how to improve biotech research is hereby given. The performed analysis presents encouraging data on patenting, even if lately the number of patent applications seems to be decreased. This also reflects the worldwide economic crises, whose first effects probably go back to some years ago. In any case, just because there must be a way out from said crises and because biotechnology is fundamental for finding new solutions in health, agricultural and food technology, interest and investments shall not lack.

For instance, it has been declared and demonstrated that available drugs, as antibiotics, are poorly effective

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Table 1. Biotechnology PCT patent applications and total PCT patent applications.

	1994-1996		2004-2006	
	Biotechnology	Total	Biotechnology	Total
Australia	297	2 566	556	6 152
Austria	68	1 119	193	3 456
Belgium	143	1 168	327	2 982
Canada	437	2 950	809	8 031
Czech Republic	11	108	14	393
Denmark	284	1 660	525	3 348
Finland	94	2 109	148	4 523
France	577	6 405	991	17 970
Germany	895	18 505	2 106	49 190
Greece	4	107	11	245
Hungary	16	244	27	564
Iceland	1	24	13	116
Ireland	34	299	50	935
ltaly	180	2 365	421	8 509
Japan	894	10 065	3 720	68 011
Korea	59	643	653	15 780
Luxembourg	1	66	2	134
Mexico	10	89	22	520
Netherlands	273	3 813	643	9 689
New Zealand	36	456	104	1 057
Norway	32	971	81	1 837
Poland	4	77	30	347
Portugal	1	30	22	231
Slovak Republic	3	48	4	106
Spain	61	819	312	3 696
Sweden	246	5 082	362	7 452
Switzerland	161	2 318	354	5 965
Turkey	1	32	5	712
United Kingdom	985	9 787	1 264	17 891
United States	7 757	56 656	11 474	139 261
European Union	3 900	54 019	7 487	132 327
OECD total	13 566	130 583	25 242	379 104
World total	13 891	134 746	27 296	418 472
	92	1 899	887	18 747
BRIICS	92	1 099	007	10 /4/
Brazil	6	220	67	1 098
China	22	358	423	11 310
India	7	49	213	2 977
Indonesia	0	7	1	45
Israel	156	1 210	428	5 374
Philippines	1	13	0	108
Russian Federation	48	1 011	147	2 173
Slovenia	11	95	15	288
South Africa	10	254	35	1 145

Source: OECD, Patent and REGPAT databases, January 2009; and EPO Worldwide Statistical Patent database, September 2008.

for certain kind of pathologies due to the resistance of bacteria and their mutations, as well as the abuse of said drugs in the past. Conversely, it is well recognized that biotechnology, and in particular genetic engineering, is the future for developing new and really effective drugs.

It is also well recognized that biotechnology needs great investments and a system able to help and safeguard said investments.

The patent system represents a powerful tool to this purpose, as well as a great source of information thanks to the nature of the patent itself, i.e. it must disclose the invention in a manner sufficiently clear and complete for it to be carried out by the skilled man in the art.

Further, the patent system is always changing to try to satisfy the developing technologies as biotech. Therefore, people involved in biotech research should know and hopefully use said tool.

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2008 patent applications per origin and technologies. Table 2.

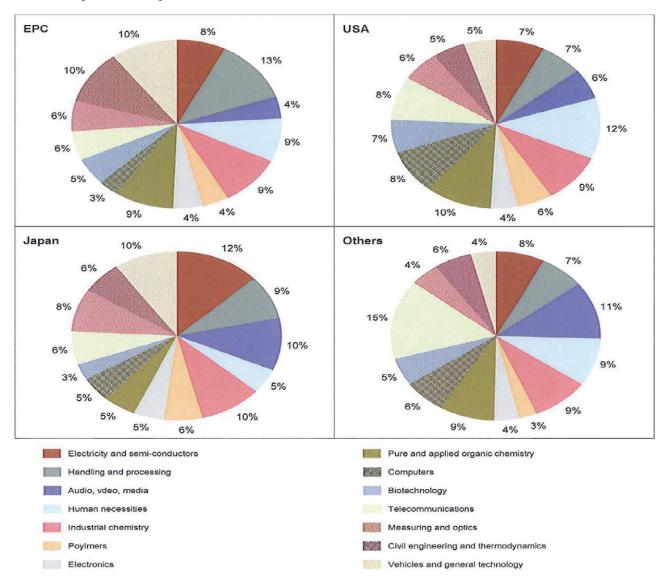


Fig. 6. 2008 patent applications per origin and technologies.

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